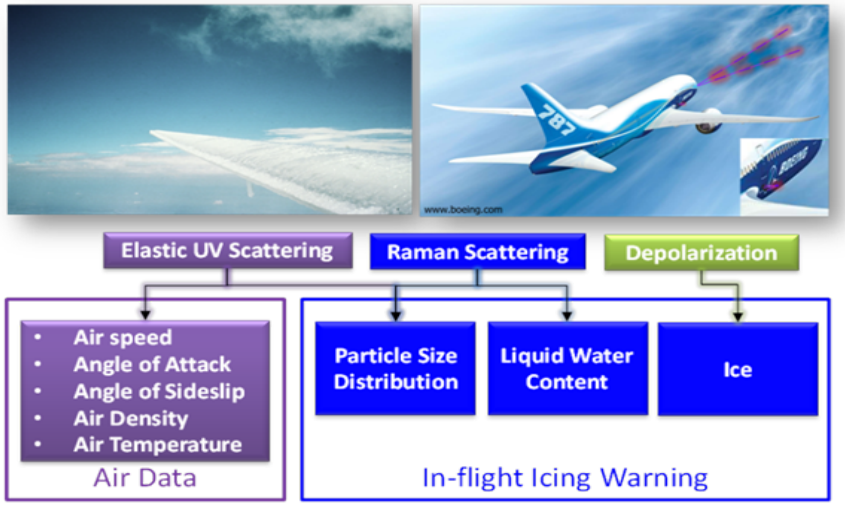
NASA SBIR/STTR Technologies

A1.01-9814 - RIDES: Raman Icing Detection System

PI: Charles Richey
Michigan Aerospace Corporation - Ann Arbor, MI

Identification and Significance of Innovation

Inflight icing of engines and airframe presents a significant hazard to air transport, especially at lower flight elevations, on approach. Ice accretions on the wings affect the smooth flow required for proper lift. Michigan Aerospace Corporation proposes to continue the development of an integrated LIDAR instrument capable of identifying icing conditions while also allowing for air data sensing as well as other hazard detection capabilities. The resulting Raman Icing Detection System (RIDES), when coupled with MAC's optical air data solution, will provide unprecedented situational awareness and aircraft safety. The proposed solution will operate without protrusions into the flow, behind a common flush-mounted window on the skin of the aircraft, mitigating the risk of ice build-up during operation and therefore providing a critical redundancy through dissimilar measurement of air data parameters while greatly enhancing a pilot's awareness of potential icing hazards.



Estimated TRL at beginning and end of contract: (Begin: 3 End: 5)

Technical Objectives and Work Plan

Technical objectives are:
(1): Complete the design of the prototype to be fabricated
(2): Complete fabrication, assembly and functional testing of the prototype
(3): Conduct calibration testing
(4): Refine algorithm and prototype
(5): Complete system demonstration.
Work plan:
--Task 1, Design Finalization: Final selection of layout & components
--Task 2, Receiver Fabrication: Receiver assembly
--Task 3, Depolarization Channel Assembly: Channel assembly & preliminary tests
--Task 4, Raman Channel Fabrication: Fabrication & assembly (includes functional testing)
--Task 5, Algorithm Development: Algorithm development and processing
--Task 6, Calibration Tests: Test in the icing wind tunnel to define calibration constants in the algorithm and allow for software and hardware design enhancements
--Task 7, Algorithm and Design Refinement: Revision of algorithms and design based on calibration testing
--Task 8, Instrument demonstration: Final demonstration of the instrument in the icing wind tunnel to validate both the design and the algorithm

NASA Applications

The system resulting from this effort will allow better studies of icing by giving clearer indications of the actual conditions outside a test aircraft in real time, providing safer and more accurate means of studying icing conditions. In addition, the system will allow for climate change studies that look at aerosol concentration and distribution, including water vapor/liquid water content, in the atmosphere.

Non-NASA Applications

Military and civil aviation is often affected by icing, sometimes severely, so the ability to detect these conditions for avoidance or to cue activation of de-icing systems would be of tremendous safety value. Combining the system with optical turbulence and ash cloud detection and an optical air-data system would result in an unprecedented, robust optical-based sensor suite for modern aircraft.

Firm Contacts

Charles Richey
Michigan Aerospace Corporation
1777 Highland Drive, Suite B
Ann Arbor, MI, 48108-2285
PHONE: (734) 975-8777
FAX: (734) 975-0239